

Teaching the Ohm's law using a data acquisition and control system: a chance for evaluating the new technologies' influence on student's attitude towards science

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Abstract – In this work we present a teaching module based on the use of a data acquisition and control system in science school laboratory. We have utilized both the e-ProLab CMC-S3 system and the e-ProLab software to develop a teaching module about the Ohm's law and we have applied it to a group of students at last grade of compulsory secondary education in Greece (14-15 years old). The module comprises of an appropriate worksheet including experimental activities, specific instructions for the use of the hardware and of the software, as well. We have worked with two teams of students, in order to evaluate our module. The first group (control group) was taught in the customary way and the second team using the system described above. By the end of the session, all students took an evaluation test concerning the understanding of Ohm's law. According to the test's results, the second group performed better than the control group. In addition, and in order to record the students' opinions about the teaching method that was followed, a questionnaire was answered by the students of the second group. The analysis of those answers confirmed that the students considered this laboratory experience very interesting and they would favour this kind of practice to be extended to other Science courses.

Keywords – Science school Laboratory, e-prolab CMC-S3, Ohm's law, evaluation.

1. INTRODUCTION

The progress of Information and communications technologies (ICT) provides powerful tools for improving the quality and the ease of access to education and training. The import of ICT in school science laboratories has caused a lot of discussions in most countries of the world, Greece included too. Various educational researches have recorded a mistrust of teachers as well as a teachers need and luck for extra qualitative pedagogical training in ICT [1], [2]. In addition it has been reported that a lot of students are already more familiarized in the use of ICT than their teachers. Thus, developing innovative ICT solutions to promote better education and training throughout a citizen's life is a special focus of the Lifelong Learning Programme [3].

The Comlab project [4] is another similar programme. This project's main objective is to integrate different ICT tools in science and technology teaching. Emphasis is on

two aspects: a) real laboratory exercises, based on a computer data acquisition and control system, recognizing that importance of practical experimentation and laboratory work has not decreased in the era of ICT, and b) virtual laboratory activities, based on computer simulations of various science phenomena which are complicated, expensive and/or involve inaccessible devices.

Our team participating in Comlab-2 (second part of the Comlab project) has utilized a specially developed device, the e-ProLab CMC-S3, in order to apply a teaching module about the Ohm's law. We have applied it to a group of 17 students (Group A) at the last grade of compulsory secondary education in Greece (14-15 years old). In order to evaluate our module the same course was, in parallel, taught to a second group of 18 students (Group B) following the customary way. The lab exercise lasted 2 school hours. The teaching module comprises of an appropriate worksheet [5] including experimental activities, specific instructions for the use of the hardware and of the software, as well.

2. LABORATORY EXERCISES

The students of group A assembled the set up showed in figure 1 and realised measurements with various resistors using ProLab.

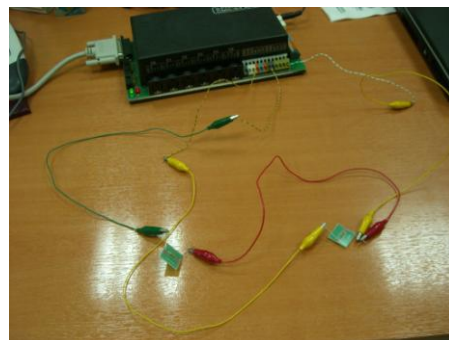


Fig. 1. Experimental set up.

The students of group B worked in the customary way (Figure 2).



Fig. 2. Students of group B working in science Lab.

3. EVALUATION

3.1 Evaluation test

In the end of the courses both of the groups took an evaluation test. The results of evaluation are presented in table 1.

	Group A	Group B
Question 1, about the estimation of the resistance using Ohm's law	12/17 (70,5%)	10/18 (55,5%)
Question 2, about the estimation of the intensity of electric current using Ohm's law	10/17 (58,8%)	10/18 (55,5%)
Question 3, about the estimation of voltage using Ohm's law	13/17 (76,4%)	11/18 (61,1%)
Question 4, about estimating the resistance using graphs	13/17 (76,4%)	14/18 (77,7%)

Table 1. Results of evaluation test

A small precedence of students of group A is obvious, though the small number of students cannot assure definite conclusions about the effectiveness of the module.

3.2 A brief analysis of the questionnaire evaluating the influence of ICT on students attitude towards science

In the following session, the students of group A were called to answer a questionnaire. The objective was to record their attitudes towards the method that was realised.

First question: "How do you characterize the instructive method?"

Indifferent: 0

Interesting: 15

Fascinating: 2

It is encouraging that no student characterizes the process indifferent while the two students that characterize it fascinating belong in those who are interested particularly in sciences.

Second question: "How do you want to be taught Physics?":

This way: 15

Customary way: 2

This result is rather expected. The two students that prefer the customary way have hard feelings towards sciences, according to their statement.

Third question: "Do you think that Physics would be more attractive for you if such experiments were realised more often in your school Lab?"

Yes: 10

No: 1

I don't know: 6

Among the students that were initially recorded as not positive towards Physics, there were five that answered "I don't know", one who answered "No" and one who answered "Yes". This means that the particular experiment did not help in the change of their attitudes. On the contrary the students who are already positive towards Physics liked this teaching method.

In the next question, asking if they met difficulties in the realisation of the experimental process, most of the students considered the directives in the worksheet satisfactory. Finally no student proposed anything that would make more efficient or more attractive the module.

4. CONCLUSION

The use of ICT in the school laboratories seems to increase the interest of students, far more than traditional teaching methods can be achieved. However, the results of evaluation that we attempted show that the use of ICT does not remarkably affect the students' attitudes toward science.

The limited sample of students that we worked with can not lead to certain conclusions about the effectiveness of the module. For this reason we have already programmed an extended research in the current school year using the e-ProLab CMC-S3, including extra equipment (e.g. additional sensors) and involving disciplines such as Biology, Chemistry and Technology.

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